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ABSTRACT

The human cognitive system may have a developmental property that makes acquisition of fluent reading skills difficult after a certain age. This problem may be seen to affect two different populations: participants in adult literacy programs who lacked access to schools as children and educated adults fluent in languages with non-Latin scripts. The former often have high dropout rates, low achievement, and frequent relapses into illiteracy. The latter report persistent problems in becoming fluent readers: slow speed, difficulty in perceiving letters in groups, dependence on sound to understand words, high error rates, tendency to forget quickly, and difficulty in reading artistic letters. Very little quantitative research has been done on adult literacy and none on this issue; the phonological problems of neoliterates and educated foreign readers are often confounded with issues of foreign language proficiency and amount of reading practice. If there is indeed such a deficiency, it may be possible to remediate it through methods that selectively create overlearning in the deficient skills, such as the Morningside method. (A guide for interviewing foreign readers is appended to the report. Contains 66 references.) (Author/KC)

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Difficulties of Adults in the Acquisition of Reading Skills: A Review of the Evidence

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World Bank
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Abstract

The human cognitive system may have a developmental property that makes acquisition of fluent reading skills difficult after a certain age. This problem may be seen to affect two different populations: (a) participants in adult literacy programs, who lacked access to schools as children and (b) educated adults fluent in languages with non-Latin scripts. The former often have high dropout rates, low achievement, and frequent relapses into illiteracy. The latter report persistent problems in becoming fluent readers: slow speed, difficulty in perceiving letters in groups, dependence on sound to understand words, high error rates, tendency to forget quickly, and difficulty in reading artistic letters. Very little quantitative research has been done on adult literacy and none on this issue; the phonological problems of neoliterates and educated foreign readers are often confounded with issues of foreign language proficiency and amount of reading practice. If there is indeed such a deficiency, it may be possible to remediate it through methods that selectively create overlearning in the deficient skills, such as the Morningside method.

This document presents the hypothesis that the acquisition of automatic reading becomes increasingly difficult as learners become adults. This hypothesis was developed by studying empirically the reading problems of two populations that have been researched very little: (a) adult participants of literacy classes in developing countries who did not attend school as children and (b) educated adults fluent in foreign languages that use scripts different from the script of their native language. The problem has not been systematically studied before, partly because such these populations are rare in developed countries, where funding for research is available. The problem is also hard to isolate. It may be confused with lack of reading practice and with low levels of language fluency.

The following sections present the reading difficulties of these two groups, a theoretical framework, evidence from the literature about the problem, potential remedies for adult literacy programs, and prospects for research.

A. Difficulties of Participants in Literacy Programs

There is a long-standing hope that if the illiterate poor learn to read, they will have access to information that may improve their lives. For that reason, many countries undertook large literacy campaigns in the 1950s, 1960s, and 1970s with the help of international organizations. The World Bank, for example, included literacy in 30 education projects between 1963 and 1985. In contrast to children's education, however, adult literacy programs have yielded disappointing results worldwide because they give stable literacy skills to relatively few people (UNESCO/UNDP 1976; Romain and Armstrong 1987). Typically, learners flock to classes, but on the average, half eventually drop out (IDRC 1979; Jennings 1990). About half fail to meet performance criteria at the end of the course, and about half the neoliterate population may later lapse back into illiteracy (Roy and Kapoor 1975). Due to this attrition, many campaigns conducted during the 1970s had efficiency rates of about 12% (UNESCO/UNDP 1976).

The difficulties of literacy programs should have generated research to elucidate and possibly remedy the problems adults encounter in literacy acquisition. Though countless policy and methodological documents have been published (e.g Lind and Johnston 1990), almost no rigorous research has been undertaken (Jennings 1990; Wagner 1991). Distance, expense, and language barriers make literacy programs in developing countries inaccessible to experienced developed-country researchers. The agencies that fund them (such as UNESCO, World Bank, UNDP) give low priority to basic research and focus on policy formulation and evaluations. Many evaluations, however, do not follow rigorous designs, and much confounding of variables takes place. Scholars who deal with literacy issues usually have to rely on data that cannot be easily interpreted, case studies, best-practice reports, and anecdotal information.

In the absence of research, the failures of literacy programs have been attributed to general social problems (e.g. Lind and Johnson 1990). Prominent are poverty and overwork, irrelevance of reading to the lives of illiterates, different expectations and goals between learners and program organizers, socioeconomic differences between teachers and learners, organizational mismanagement, and lack of reading practice. (Oxenham 1975; Lind and Johnston 1990; New Era 1989, 1990; Jennings 1990.) The factors that create low achievement and high dropouts in formal schools of developing countries (such as lack of resources, teacher training, and supervision) are also considered responsible for the low achievement of adult programs Comings, Shrestha, and Smith (1992). In response, more recent programs have focused on preventing dropout by linking literacy with income-generation activities and raising literacy consciousness at the community level (such as the Total Literacy Campaigns of India). But even the more successful programs continue to have

performance problems. Of 247 Total Literacy Campaigns conducted in various Indian localities from 1990-1994, only half had participants showing more than 50% achievement scores (National Literacy Mission 1994).

The social factors may be very important in determining who goes and who stays in class, but the information processing factors should not be neglected. When adult illiterates succeed in completing literacy classes, they often end up with skills of limited utility, and lengthy or complex texts may be beyond the limits of their patience. They often read slowly, sound out letters, and may make many mistakes. To read materials other than textbooks they need post-literacy training. Word segmentation and instant recognition, the hallmarks of fluent reading, are not skills often mastered in literacy or even in post-literacy courses. At the early stages, the difficulty can be attributed to lack of practice, but apparently it persists even after 2-3 years of practice (Carron, Mwiria, and Righa 1989).

It is difficult to disentangle individual and social factors without extensive research, but the possibility of age-related cognitive difficulties must be considered. Empirical observations suggest that in the same poverty-stricken environments, children become fluent readers more quickly than adults, that older children or young adolescents seem the easiest to train, and that adults above 40 rarely become functionally literate (Jennings 1990).[1] That children would have an advantage over adults in reading acquisition seems implausible. Younger children score lower in a number of cognitive ability tests than do adolescents (e.g. Woodcock and Johnson 1989; 1990), have more limited vocabulary, and apparently learn the basics of reading more slowly. Yet, they may have an advantage; one study found that Egyptian children who had become literate before dropping out of school tended to improve their literacy skills rather than lapse back into illiteracy (Hartley and Swanson 1986). On the other hand, adults who learn to read in literacy courses often lapse back into illiteracy (Jennings 1990). Is it possible that laborious reading might cause, in part, the large dropout of literacy classes and relapses into illiteracy? If reading is tedious, neoliterates may not engage in it unless it is absolutely necessary and may practice the skill less frequently than is necessary for speed increase and consolidation. Then tedious reading may prevent neoliterates from acquiring functional, stable literacy skills.

The issue of age has been given little attention in literacy, but a relationship between age and performance in literacy classes is to some extent documented. Of the project evaluations found to report data on participant ages, nearly all indicated a relationship between performance in literacy classes and age (See Abadzi 1994 for a review.) Confounded variables (e.g. gender, marital status, and number of children) make the relationship difficult to interpret. Nevertheless, the data leave open the possibility that children and adolescents may become expert readers more easily than adults.

B. Adult Foreign "Neoliterates"

Another category of readers seems to have difficulties in acquiring fluent reading skills. These are fluent foreign speakers of languages with non-Latin scripts, who learned to read these scripts as adults. Such people, who are often highly educated professionals working in foreign countries, are articulate about their reading experiences and report difficulties that might help shed light on the information-processing aspects of learning a new script. Examples are (Abadzi 1994):

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[1]/ UNESCO distinguishes between basic literacy, the ability to read a few words and sign one's name vs. functional literacy, the ability to obtain information from written materials (Lind and Johnston, 1990).

- Three American Peace Corps workers spent about seven years in Nepal in their mid-twenties. Although they spoke Nepali fluently and taught in it, they had to make an effort to read the Devanagari script despite its very orderly sound-letter correspondence. They tended to avoid it and forgot to read faster than they forgot to speak after they left the country.
- A British teacher who spent 15 years in Bangladesh developing literacy materials has the vocabulary to understand televised news but finds reading of the same vocabulary in newspapers tedious.
- An American woman in her mid-thirties who has lived in Japan for seven years and who speaks to her children in Japanese, still does not fluently read Katakana, the syllabic script reserved for foreign words.
- A Greek engineer who studied and worked in Israel for 23 years after secondary school instantly identifies many words and reads materials in his field very fluently but still finds general Hebrew books tiring and believes that he still reads 2-4 times faster in his native Greek language, which he rarely uses.
- A 40-year-old German who serves as the interpreter of a Lama and who has read Tibetan extensively for 21 years, still reads Tibetan texts more slowly than texts in English, which is not even his mother tongue.
- An American professor of Slavic languages reads Russian (written in the Cyrillic script) more slowly than Polish (written in the Latin script), although he has worked much more extensively with Russian.

These self-reports suggest lingering difficulties with scripts learned in adulthood. If adults have no special problem in learning to read new scripts, one would expect that educated people would read a foreign language about as well as they could speak it. For fluent speakers living abroad, opportunities for practice are abundant. In urban areas there are store signs, street signs, newspaper headlines, billboards, or TV titles which do not require sophisticated vocabulary. Yet many fluent foreigners report passing these by without decoding them unless they specifically need the information. They seem stuck with a skill level that children which attend relatively effective schools display at the end of the first grade. Why?

To begin understanding the problem, informal interviews were held in 1991-1995 with 11 fluent foreign speakers of languages with non-Latin scripts who had lived for 5-43 years as adults in countries where these languages are spoken (Abadzi 1994). An interview guide was developed on the basis of earlier self-reports (Appendix 1). Subjects were asked to read available passages in their mother tongue as well as in the foreign script they knew and to reflect on their reading habits and strategies in the two scripts. They consistently reported reading problems that seem related to *speed, accuracy, and lack of automatic reading*. These are summarized below:

(a) A rapid start but an early plateau. With a knowledge of reading strategy, foreign readers learn the letter-sound correspondences of a new script fast, often within 3-4 days. However, subjects report reaching a plateau soon, and their reading speed increases very slowly thereafter; slow improvement has been reported to continue for many years. By contrast, children show a rapid increase in their pattern recognition skills and speed after learning basic sound-letter correspondences (Feitelson 1988; Adams 1990).

(b) Limited pattern recognition. The foreign readers interviewed tended to see individual letters rather than combinations. By contrast, children develop very rapid recognition of many frequent words, and as they become experienced native readers they typically perceive combinations rather than individual letters (Adams 1990). Words of 2-3 letters may be recognized immediately by foreign readers as well as very frequent words (such as names of cities), but the rest must be deciphered letter by letter. This makes scanning of a text difficult or impossible. When scanning is necessary, some easily identifiable letters (e.g., rare letters) may be searched rather than a

whole word. Nevertheless, foreign readers seem to learn quickly which letter combinations are more or less likely in a language, and they can predict probable words. Infrequent combinations tend to produce extra difficulty.

(c) Slow speed and consolidation. It takes much longer to read a passage of known words in a foreign script. It may take a foreign reader, for example, five seconds to read a two-line sign on a doorway, whereas an expert reader may need less than a second (Adams 1990). One foreign reader reports trying to imprint in mind the letters of store and road signs while in a passing car in order to finish reading them from visual memory. When asked to read aloud a text of known vocabulary, foreign readers often read haltingly. Speed may increase after practice, but it may drop again if a few weeks pass without reading. Even after considerable practice, people may eventually forget the shapes of letters.

(d) High error rates and overdependence on context. Letters are often misread, resulting in delays and aggravation due to wrong interpretations. Like low-performing young readers (Adams 1990), foreign readers may depend too much on context and may read what they expect to see, thereby significantly misreading the print. Some letters may be recognized faster than others, and readers may read only those when they read fast, often coming up with guesses that include these letters in a scrambled order. Some visual details in words may not processed, and more errors may result.

(e) Continuing need to sound words and infrequent segmentation. Foreign readers have to sound out most words to get the meaning and seem not to segment words as they read. Long words, therefore, create frustration. By contrast, expert readers translate letter patterns directly into meaning and read long words by cutting them in parts (Adams 1990).

(f) Difficulty with nonstandard letter shapes. Artistic, computer-generated letters, or simple handwriting may present particular reading problems. By contrast, native readers seem to be influenced very little by variability of shapes (Adams 1990).

(g) In a perpetual beginner stage. Native experienced readers read effortlessly and unconsciously. They cannot help but read a message thrust in front of them. Most foreign readers do not read like experienced readers. Reading may become habitual (i.e. decisions don't have to be made for every letter), but not effortless; the words do not "fly out" at the reader. One persistent reader estimated having read in Devanagari as much material as a student in 10 grades of school and still having the fluency of a second grader. Because continuous effort is needed, reading in a foreign script *is not fun*. It takes effort, and even perfectly fluent speakers tend to avoid it.

One might think that the difficulties of foreign readers are due to language problems. However, the self-reports of foreign readers point to a perceptual problem rather than to linguistic difficulties or lack of practice. Foreign readers have trouble deciphering the print before they determine in which language it is written. Furthermore, they have much greater difficulty reading, for example, English-language text in the Thai script than Thai text, although English word meanings should be instantly accessible to them. Even experienced foreign readers report that it is easier to read a foreign-language text in the Latin script than to read the foreign script, although the Latin letters may create ambiguities in meaning. Though they may read with difficulty, foreign readers often process high-level material, such as documents for a dissertation and texts on buddhist philosophy. Their difficulty, therefore, seems to be "low-level", i.e. phonological rather than semantic or related to strategic reading.

The difficulties both illiterates and educated readers face make sense if adults in general perceive and process newly learned alphabetic symbols more slowly and less accurately. As a result of less efficient processing, adults may not see adjacent symbols as combinations and may require much longer periods than children to acquire automaticity. Thus, fluent reading and expert reading skills may be more easily acquired during childhood and adolescence than during adulthood.

A Theoretical Framework

How could this problem arise? The Seidenberg and McClelland model will be used as a theoretical framework because it provides considerable detail at the phonological level.

According to Seidenberg and McClelland (1989) reading involves four processing mechanisms with feedback loops: phonological, orthographic, meaning, and context. As the visual image of a string of letters is processed, excitatory stimulation is sent to corresponding units in the phonological processor, which determines whether the letter string is pronounceable. If it is, the phonological processor will signal the orthographic processor of that fact and prod the meaning processor for possible interpretations. Then the context processor will give connotations of the word. But if a string of letters is not pronounceable, the phonological processor will stimulate the orthographic processor to send alternative visual patterns. So, the activation of a word's pronunciation automatically arouses its meaning, and the activation of a word's meaning results in the excitation of the phonological units underlying its pronunciation. With reading practice, processing becomes automatic, and letter combinations are recognized through modular operations (Stanovich 1991). Modular operations are encapsulated; they occur rapidly, without an individual's attention, and are not influenced by prior knowledge structures stored in long-term memory. This encapsulation allows for efficient word recognition independent of context. In this way, people recognize, learn about, and understand what they have read (Adams 1990).

Though linguistic processing is very important to reading, visual processing is critical (Adams 1990; Stanovich 1991). The immediate and long-term impact of reading depends on the speed and accuracy with which readers can identify the individual letters and words of the text. The output of the orthographic processor depends on the speed and adequacy with which the individual letters are perceived. When the input is slow or mistaken for some reason, a letter pattern is perceived incorrectly or not as a pattern; the brain does not know that the letters have co-occurred. Then the phonological processor compensates for the laborious output from the orthographic processor by creating repetition of letters and syllabication. When this happens, people may have to sound out the letters in order to keep the string in memory long enough to understand the meaning; but the meaning processor depends on the quality and completeness of the orthographic and phonological processors. If the input is mistaken, the meaning processor will not find correct interpretations. Therefore, a person who perceives letters slowly and/or inaccurately may have to put considerable effort in reading a message and in understanding its meaning.

The laborious processing of texts by neoliterates and foreign readers is often evident to a listener. As mentioned earlier, foreign readers have trouble deciphering the print before they determine which language it is written in, and make many mistakes in reading letters. The problem, therefore, seems to involve visual processing speed and accuracy. For some reasons, the input from the orthographic to the phonological processor seems slow and erroneous. The phonological processor may compensate through repetition and syllabication, and readers may have to sound words out before they can understand them. The incorrect and slow output, in turn, often

misleads the meaning and context processors into wrong interpretations or decisions that a word is unknown. Inefficient visual processing may also account for the difficulty foreign readers have with more artistic letters, which proficient readers hardly notice (Adams 1990). If neoliterates also have visual processing difficulties, they would also be expected to read with difficulty and to read only the most standardized print.

If adults indeed have a visual processing difficulty of new letter patterns, what could it be due to? A form of brain damage related to reading may provide some clues. Through PET (Positronic Emission Tomography) scans, Petersen, Fox, Snyder, and Raichle (1990) researched a word-recognition spot that lies at the left medial extrastriate visual cortex, anatomically very near the part of the brain that deals with visual information. The neurons of the spot determine whether a set of letters conforms to the spelling rules, like the phonological processor hypothesized by Seidenberg and McClelland. Brain damage to this spot may result in a disorder called alexia. The alexic person can write perfectly spelled words, but to read s/he must slowly go over each word letter by letter, like many neoliterates. One explanation for the problem of these learners is that changes in the brain as it reaches adulthood influence the "wiring" of the word-recognition spot, and it may somehow become less and less capable of checking spelling in an unknown writing system as age advances. The ability to advance to modular, automatic reading may then be lost. This may doom adult learners of a writing system to slow, letter-by-letter recognition of a word, much like alexia sufferers.

However, the problem with neoliterate adults may not be in the rule checker itself. Foreign readers do learn spelling rules of foreign words, know which letter patterns are more likely than others, and read more familiar patterns faster. But many still find it faster to read a foreign text transliterated in their native script, despite ambiguities that may arise[2]. Petersen et al.'s (1990) findings would predict the opposite, because Latin-letter spellings of foreign words would not conform to the rules built in the word-recognition spot for these words. If the rule checking mechanism can learn new letter and spelling patterns, then the problem may occur at an earlier stage, perhaps in neural networks that lie in the path between the eyes and the rule checker. Subtle reductions in the speed of nervous impulses in areas responsible for pattern formation may increase the reaction time to letters by a few milliseconds between adolescence and early adulthood. Such an increase might prevent the almost simultaneous reading of letters and recognition of letter combinations as patterns. Then letters would be read one by one as they arrive, and rule-checking would be suspended. Without the activation of the rule checker, words would not be recognized instantaneously.

What is the minimum speed necessary for letters to be recognized as patterns? Little research appears to exist in this area. Though research has been done on reading speed (e.g., Graesser, Hoffman, and Clark 1980), data on reaction time and pattern recognition for the young and middle-adult ages are very sparse and do not permit confirmation or refutation of the hypothesis. A better understanding of pattern-recognition mechanisms in the brain would be needed to pinpoint the location of the hypothesized problem further.

A potential developmental framework. Could the acquisition of automaticity have a critical period? The question echoes the hypothesis of a critical period for language acquisition. Earlier it was thought that language acquisition is irrelevant to reading acquisition (e.g. Wardhaugh 1971). However, the work on phonological awareness (Bertelson, De Gelder, Tfouni, and Morais 1989) indicates that these functions may be somehow related. The dispute on whether there is developmental facilitation for

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[2] The need for the brain to check the rules of spelling in order to swiftly recognize the word may lie behind the particular difficulty foreign readers have in recognizing English words in foreign scripts; they may have a different set of spelling rules for them in their brains.

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language has not been settled, but evidence is increasing in its favor. Studies (e.g. Johnson and Newport 1989) have showed that younger learners more easily acquire native-level use of a language, and there is a clear advantage until puberty. An extensive literature review on language development (Long 1993), which distinguished between short-term (rate) and long-term (attainment) studies concluded that: (a) adults proceed through early stages of morphological and syntactic development faster than children; (b) older children acquire language faster than younger children; and (c) child starters outperform adult starters in the long run. These conclusions echo observations regarding the performance of children, younger adolescents, and adults in literacy classes (Jennings 1990). It is tempting to hypothesize a critical period for the acquisition of fluent reading until puberty, after which the attainment of automaticity becomes increasingly difficult.

If adult learners indeed find it hard to become fluent readers, at what age does the problem become significant? The many people in the world who can function comfortably in two or more scripts learned them during their school years. Many examples also exist of university students who learned a foreign language and script for studies (such as Chinese students in the US). Two such persons, who learned to read Hebrew and Tibetan at ages 18 and 19, have indicated in informal interviews with the author that they perceive many letter patterns, though years later they may still read more slowly than in their native script and not prefer it. It is conceivable that the difficulty becomes significant around age 18, but its progression in previous and subsequent ages cannot be inferred.

How much practice is needed in various ages before automaticity is achieved? The few anecdotal reports of fluent readers (such as foreign priests who read mass in Bangla every day and a missionary who has read Bangla for 45 years) imply that effortless reading may eventually be achievable. On the other hand, reports of persons in mid-adulthood (such as an American professor of Bangla, who has read it almost daily for 26 years) indicate continued slow performance despite large amounts of reading. More discouraging is a report by a middle-aged American professor of Russian who started studying Russian at 17. The Cyrillic and Latin alphabets have several letters in common, yet this professor still finds Russian (written in Cyrillic) slower to read than Polish (which he knows less well). It is possible that the amount of practice needed to perceive patterns that will make the phonological processor work efficiently increases with age until it reaches an asymptote.

Evidence Regarding the Hypothesis

Evidence in the literature regarding the validity of the hypothesis that the acquisition of automatic reading may be affected by age is sparse and tangential. The issue has simply never been researched, and no study was found that assessed reading acquisition across ages. Some possibly relevant findings in the cognitive and perceptual literature are:

(a) A significant relationship has been found in college student samples between reading fluency and the speed of accessing information in memory, which may be important in finding letter codes and patterns (Jackson 1980; Jackson and McClelland 1979; Palmer, MacLeod, Hunt, and Davidson 1985). Relative to less skilled readers, college students who score highest on tests of reading speed and comprehension are faster at gaining access to the name codes stored in long-term memory. If reaction times become longer as age advances, retrieval of letter meanings might be slower and slow down comprehension.

(b) Older adults perform at lower levels than young adults in perceptual-motor skills, but they exhibit similar amounts of improvement with moderate to extensive practice. This is true in tasks ranging from perceptual

discrimination (Ball and Sekuler 1986; Salthouse and Somberg 1982) to reaction time (Beres and Baron 1981; Berg, Hertzog and Hunt 1982; Salthouse and Somberg 1982). In the development of automaticity for motor skills, younger and older subjects improve almost equally (Fisk, McGee, and Giambra 1988; Fisk, Rogers, and Giambra 1990; Fisk and Rogers 1991; Madden 1983; Madden and Nebes 1980; Plude and Hoyer 1981; Plude, Kaye, Hoyer, Post, Saynisch, and Hahn 1983; Salthouse and Somberg 1982). However, older adults may be less capable than young adults of learning to perform various motor tasks with automaticity. One possibility suggested by Fisk and Rogers (1991) is that age effects in the development of automaticity are evident when the search is through a visual display but not when the search is through items in memory. Nevertheless, small or no age differences were apparent in two experiments reported by Fisk and Rogers (1991), and thus the factors contributing to possible age differences in the development of automaticity are still not well understood.

(c) There have been several reports investigating relations between age and the successful completion of air traffic controller training. Perhaps because this is an occupation with high demands for rapid processing of visual and spatial information, increased age has been found to be negatively related to probability of success (Cobb, Lay and Bourdet 1971; Trites 1963; Trites and Cobb 1964a 1964b). In fact, the failure to success ratio has been reported to be 1-to-1 for trainees under the age of 35, 4.7-to-1 for trainees over the age of 35, and as high as 7.4-to-1 for trainees over the age of 39. Also, it appears that increased age is associated with reductions in the efficiency or effectiveness of segmenting and integrating perceptual displays (Salthouse 1991). Unfortunately, analytical studies that might have been informative about the reasons for the relation between age and rate of failure have apparently not been conducted.

(d) The existing cognitive and perceptual research seems to rule out age-related declines in intellectual functions and motor activity as obstacles to learning fluent reading. Studies of abilities related to reading success, such as verbal memory, indicate that age differences do exist, but they do not necessarily affect the acquisition of a new script (e.g., Scribner and Cole, 1981; Salthouse 1992; Salthouse and Babcock 1991; Salthouse and Somberg 1982; Charness and Campbell 1988). The problem might be found in perception-related variables that have been researched little with respect to age, such as segmentation of visual displays, and the little-understood problems of air traffic controller trainees.

In the foreign-language literature, there are references to the reading difficulties of students faced with new scripts (Bernhardt 1991a, Ramirez 1994). When English-speaking readers of common European languages read, they are already fairly sophisticated in word recognition and need little oral reading practice. The same reader learning non-Latin alphabets is much more like a child learning to read a first language. Because processing speed depends on fluency as well as on familiarity with orthography, students of languages with non-Latin scripts (e.g., Arabic, Chinese) pay considerable attention to graphemic features and less attention to meaning or syntax (Bernhardt 1991b; Alderson 1984). However, the limited foreign-language knowledge of students makes it hard to disentangle linguistic from perceptual difficulties.

The difficulties of neoliterates with fluent reading have been occasionally discussed in the literacy literature, but they have been attributed to lack of familiarity with different texts. As a result, some authors have written that there are different "literacies" (Rogers 1991; Street 1984) and they call for assessment of neoliterates' performance with material they know best. But the concept of different "literacies" may be specious. Less accomplished readers tend to read better the texts about which they know more (Adams 1990). Like dyslexic children, neoliterates may rely on

the meaning and context processors to guess a word that they have only partly read. This may be an effective coping mechanism for dealing with print, but it clearly indicates that there is a problem. A reader with relatively strong recognition skills does not rely on context as much as does a weak reader (Sprenger Charoles 1991). The need to postulate different "literacies" reinforces the possibility that neoliterates have visual processing difficulties.

In conclusion, the literature of several fields gives no definitive answers, but leaves open the possibility that the hypothesized deficiency exists. The psychological literature seems to rule out cognitive deficiencies, but suggests the existence of some subtle perceptual problems for adults. These may be responsible for erroneous and slow input to the phonological processor of readers learning a new script.

Prospects for Improving Adult Literacy Programs

The hypothesis stated above has some clear, though indirect, implications for literacy programs. Reading speed and accuracy are probably not the most important factors that determine the success of literacy programs in developing countries. As other authors have suggested (e.g. Oxenham 1975) the probability of an adult becoming literate through a course is probably a function of many personal, environmental, and instructional variables. The concern is that age-related processing difficulties may interact with some variables and magnify their effects. For example, if effortless reading is harder for adults to attain, the poor, malnourished, overworked, and possibly farsighted participants of literacy classes may become more easily frustrated and drop out, citing housework as a convenient excuse. To keep participants, literacy agencies programs are increasingly making courses responsive to participants' needs. It is conceivable, however, that after the design of literacy programs is improved to better suit the instructional and social needs of learners, automatic reading and stable skills may still remain beyond the reach of many participants.

There is a strong tendency world-wide to abandon adult literacy programs and to emphasize primary education for children. However, attention to information-processing issues in conjunction with attention to social variables, may increase the effectiveness of adult classes. Adults have some strengths over children in the acquisition of literacy, such as a greater facility in learning sound-letter correspondences and a reading strategy. Instructional approaches should be designed to build on the strengths of adults and to counterbalance possible weaknesses. Examples are of potential interventions are:

Acquisition of stable reading skills. It is possible that perceptually based interventions can significantly improve the performance of new adult readers. If adults do not perceive patterns of letters as efficiently as children, then the phonics rather than the whole word method should be more useful for them. Phonological awareness exercises may be useful. Adults appear to learn sound-letter correspondences more quickly than children and may be more likely to retain letter shapes they can relate to known information items. If so, methods such as mnemonics could be used to make the memory of letter patterns permanent (e.g. Atkinson and Raugh 1975). Extra attention could be given to activities that help consolidate letter patterns, such as writing, which often receives relatively little emphasis in literacy classes. Multichannel inputs would also expected to be effective. (See Abadzi 1994 for a review of potential methods.)

Improvement in speed and accuracy. The only recommended method to increase speed at this time is extensive practice. No clear methodology has emerged on how to speed up attainment of automaticity, although researchers have deliberated on this issue (e.g., Segalowitz, Poulsen, and Komoda 1991;

Alderson 1984; Red 1992). The Morningside model of generative instruction (Johnson and Layng 1992), however, may provide a methodology for improving the reading achievement of neoliterates. This method breaks down instructional skills that are not mastered into their component parts and intensely teaches learners the parts they do not know until they achieve high accuracy rates at high speed. Johnson and Layng found that such overlearned skills do not deteriorate with time. When component skills are learned well, the higher-order skills that depend on them are often mastered. For example, readers who may decipher the print with great effort could have systematically slower reaction times for specific letters or letter combinations of a script. They could receive intensive practice in rapid recognition of these letters and their combination, until they recognized them rapidly with almost no errors. Then their overall reading speed might increase.

Preventing relapse into illiteracy. Neoliterates may be found to forget certain letters more easily, and perhaps forgetting two or three key letters may prevent recognition of words and cause relapse into illiteracy. With language-specific information, it may be judicious to present the most easily recognized letters first in order to reinforce learners early, to give extra practice to letters or combinations that are found to generate high error rates, and to provide mnemonics for letters that may be easily forgotten.

Monitoring of learning. If adult participants of literacy classes are able to discuss how they perceive script, one strategy might be to help them improve their metacognitive strategies for reading. Then they may understand how they view print and what decisions they must make in order to decipher it. They might be taught how to read faster by focusing on graphemic features they know well, yet avoid the traps of misreading words; what they must do to make sense from the texts without losing the thread of thought during the time it takes to read them; and how to monitor and prevent relapse into illiteracy.

Unfortunately, the sophisticated methods that would increase performance also require well-trained and well-educated literacy teachers, which in the developing world are rare. Nevertheless, the literacy textbooks and teachers' guides could outline cognitively based activities which little-educated teachers can undertake. Much textbook development takes place in literacy agencies, and there is institutional capability to improve the instructional value of texts.

Prospects for Research

Adult literacy in developing countries presents rich research prospects for basic as well as applied research. Yet, very little has taken place. The international agencies that fund such programs have tight budgets that may not accommodate the expense of robust research designs. Researchers who could obtain research funds are typically in industrialized countries, which have few adults who are illiterate due to lack of schools. Therefore, aside from studies of phonological awareness with illiterate Portuguese farmers (such as Bertelson and de Gelder 1989) and the informal acquisition of writing by the Vai tribe of Liberia (Scribner and Cole 1981), there has been almost no experimental research on adult illiteracy. If significant progress is to be made in adult literacy, however, substantive research is needed to understand how persons of various ages and situations learn to read new alphabets and what must be done to improve their performance.

The following suggestions are given in hopes that interested investigators can undertake such research and eventually help improve adult education programs:[3]

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[3] The author's current position does not permit execution of research.

- What is the relationship between reading speed and the ability to decode text through modular processes? How much practice is needed before readers of different ages acquire automaticity? Perhaps the high reading speeds common to the industrialized world are not required; in environments with limited opportunities for reading, one can see older readers reading slowly but apparently having stable, usable skills. Automaticity could potentially be measured through dual processing techniques.

- Are there critical letters or critical positions of letters that affect the function of the orthographic, phonological, and meaning processors in various languages? Are there perhaps systematic tendencies to recognize certain letter patterns with greater ease or difficulty than others? If so, what levels of speed and accuracy should be achieved for specific letters and/or combinations before effortless reading is achieved in a certain script? Systematic work needs to be done in measuring reaction time and accuracy of recognition for letters and patterns with learners of various ages and in various stages of reading proficiency. It could thus be determined what minimal reaction times are needed in order for letters to be perceived as patterns and how much practice is needed at various ages before attaining speeds that create the perception of patterns. A hardware-software system that assesses the speed and accuracy of problem readers in response to letter stimuli could be used such as the Computer-based Academic Assessment System (Royer and Sinatra 1994).

- What levels of reading speed and accuracy correspond to various levels of reading comprehension? Research must be conducted with respect to how comprehension develops in a literacy course. In particular, it must be better understood how the attentional resources of adults are apportioned to the decoding effort and to comprehension in various levels of literacy skill and how the performance affects the probability that a neoliterate will keep reading.

- Does age make the acquisition of fluent reading more difficult? The hypothesis could be easily tested in a country (such as India) that has extensive nonformal education programs for adults, adolescents, and children. Classroom conditions could be controlled, randomly selected participants could be paid for attendance, and reliable measures of achievement could be used. Because illiterates often do not know how old they are, reliable anthropological estimates of age should be used. In a more academic setting of developed countries, students of various ages could be taught to read a script. The extent to which the visual cortex perceives whole words in various stages of learning a new script could be researched through PET scans.

- To what extent are difficulties of foreign readers due to language or to inference by another script? The effects of language mastery could be separated from the effects of a new script. This might be done by teaching a script to educated native speakers who did not learn to read in their mother tongue as children, such as some French-educated Arabs or speakers of various Indian languages who did not learn to read in their mother tongue. (College students with good command of their parents' language but with no knowledge of script are probably easy to find in the US and western Europe.) Interference of spelling rules from another script could be studied through languages that are written in two scripts. Examples are the Hindi and Urdu scripts of Hindustani and Jawi, the Arabic script for Bahasa Malaysia. Native speakers who know one script could learn the other for experimental purposes. The extent to which biscriptural individuals instantly recognize patterns could be assessed through PET scans.

- What is the minimum amount of instruction that will create sustained skills in illiterates of various ages and what characteristics should that instruction have? What is actually forgotten after relapse into illiteracy? (letter shapes? patterns? reading strategy?) What techniques can maximize

retention of literacy? If some letters and combinations are processed with greater ease or difficulty than others, how could this information be used to improve instruction? Considerable educational research must be done with literacy classes.

Research should be conducted with representative samples of normal populations who had no access to schools as children. It may be tempting to locate illiterate subjects in developed countries, but those who remained illiterate despite school attendance may differ in several ways from people who were deprived of schooling. A few illiterates without schooling (particularly older women) can be found among immigrants in Europe and the US, but field work in developing countries would have much better generalizability. Language and script barriers can seem daunting for some researchers, but the Latin script is used for many languages that have illiterate speakers in Africa and Latin America. Furthermore, there are countries with significant illiteracy in English and French dialects, such as Jamaica and Haiti. Although much of this research would be language-specific, the data on how illiterates process print in one language would provide useful information for other languages.

Studying illiterates in their own countries can be quite costly and it requires steady sources of funding. Prospects may improve. International agencies are increasingly willing to acknowledge that basic processes are not understood in the acquisition of literacy and some of them may fund research in this field. Hopefully, better understanding can lead to improved methodology or targeting of populations most likely to learn effortless reading.

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Appendix 1

Interview Guide for Foreign Readers

Please consider a language that you know quite well, with a non-Latin script, which you have considerable experience in reading. Read a passage with well-known vocabulary in your mother tongue and in the foreign language and reflect on the following questions:

- How does your speed in reading texts with known vocabulary in the foreign script compare with the speed of reading the same level of language in your native script?

- If you read more slowly in a foreign script, why do you think this happens?

- Do you use different methods to read your native vs the foreign script? (e.g. focus on the middle of the English words vs. start from the beginning of foreign-scripted words?)

- Do you have to sound out the script in your mind before you make sense out of it? What proportion of the time? Which words or what kind of text?

- Do you have to make a conscious effort to read or do you instantly and effortlessly recognize most of a foreign-scripted text (e.g., store signs)?

- What types of words are you most likely to instantly recognize? What features account for this instant recognition? (frequency, something special about the characters used, particular character combinations)?

- Do you read artistic letters (e.g. in store signs) as easily as plain ones?

- Do you decipher English words in that script as easily as foreign words?

- Is it faster or slower to read the foreign-language text in the Latin script than in its own script?

- What happens to your speed of reading if you have not read anything for a few months?

- Can you scan a text for a word or concept? What do you do when you scan?

- At what age did you learn to read <u>effortlessly</u> in the foreign script? (or, when did the letters start "leaping out" at you?)

- How long did it take you to become fluent in the foreign script?